Aurora Parameterization in the TIE-GCM Model

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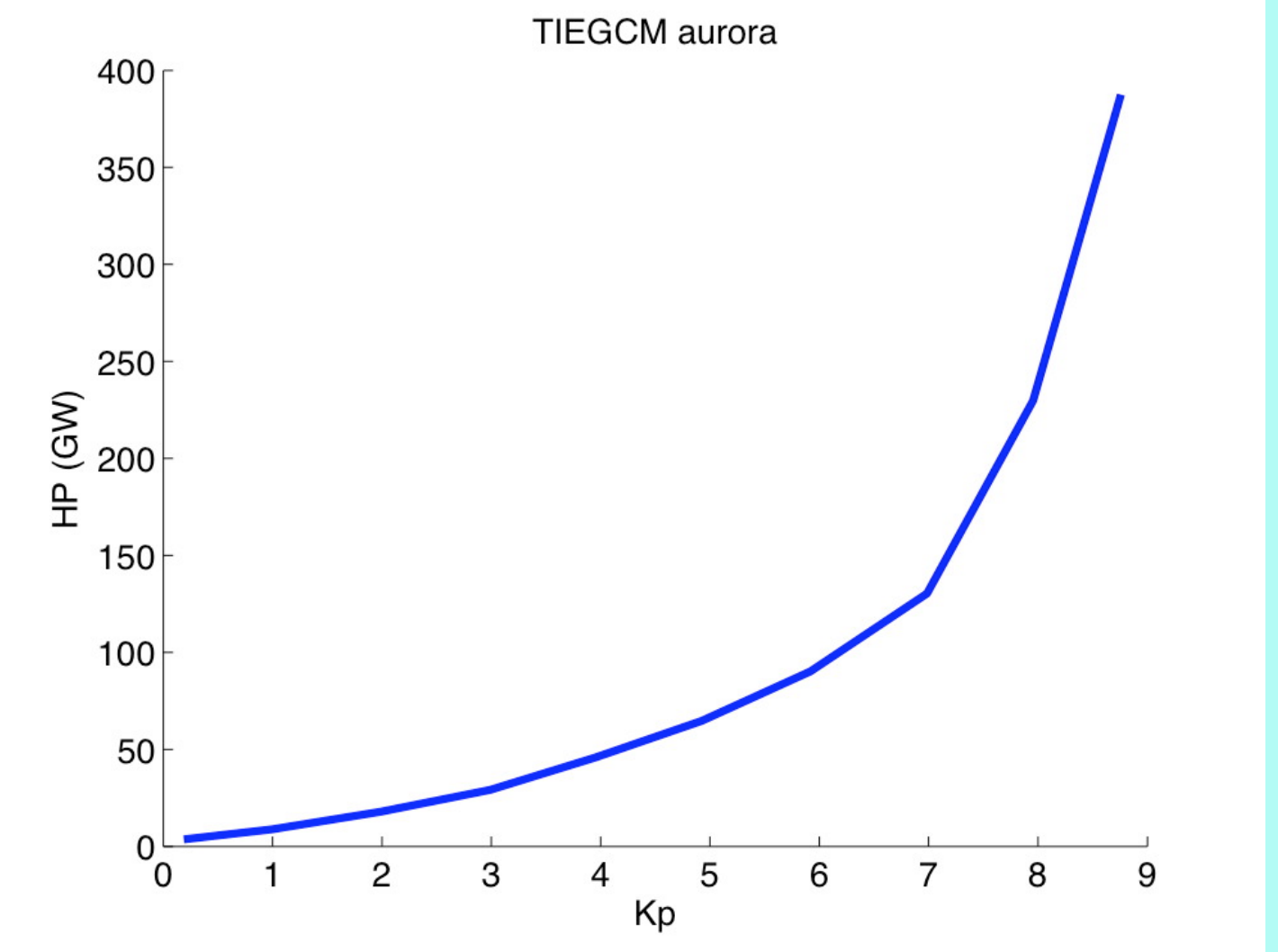
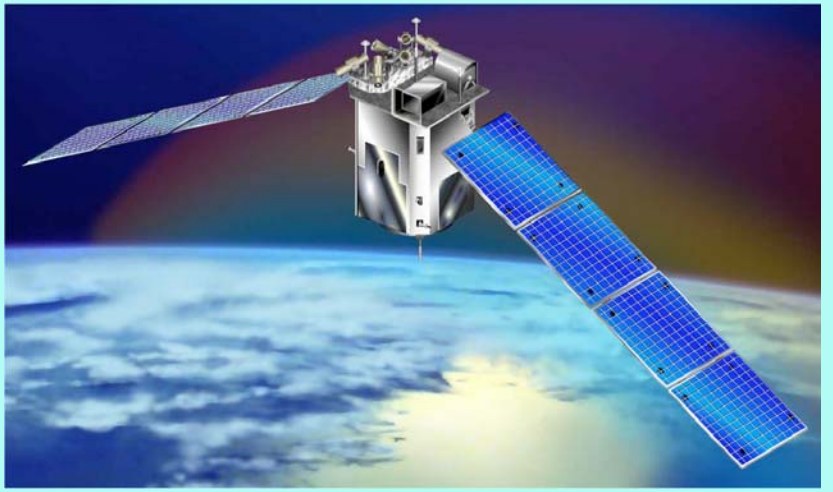
HAO

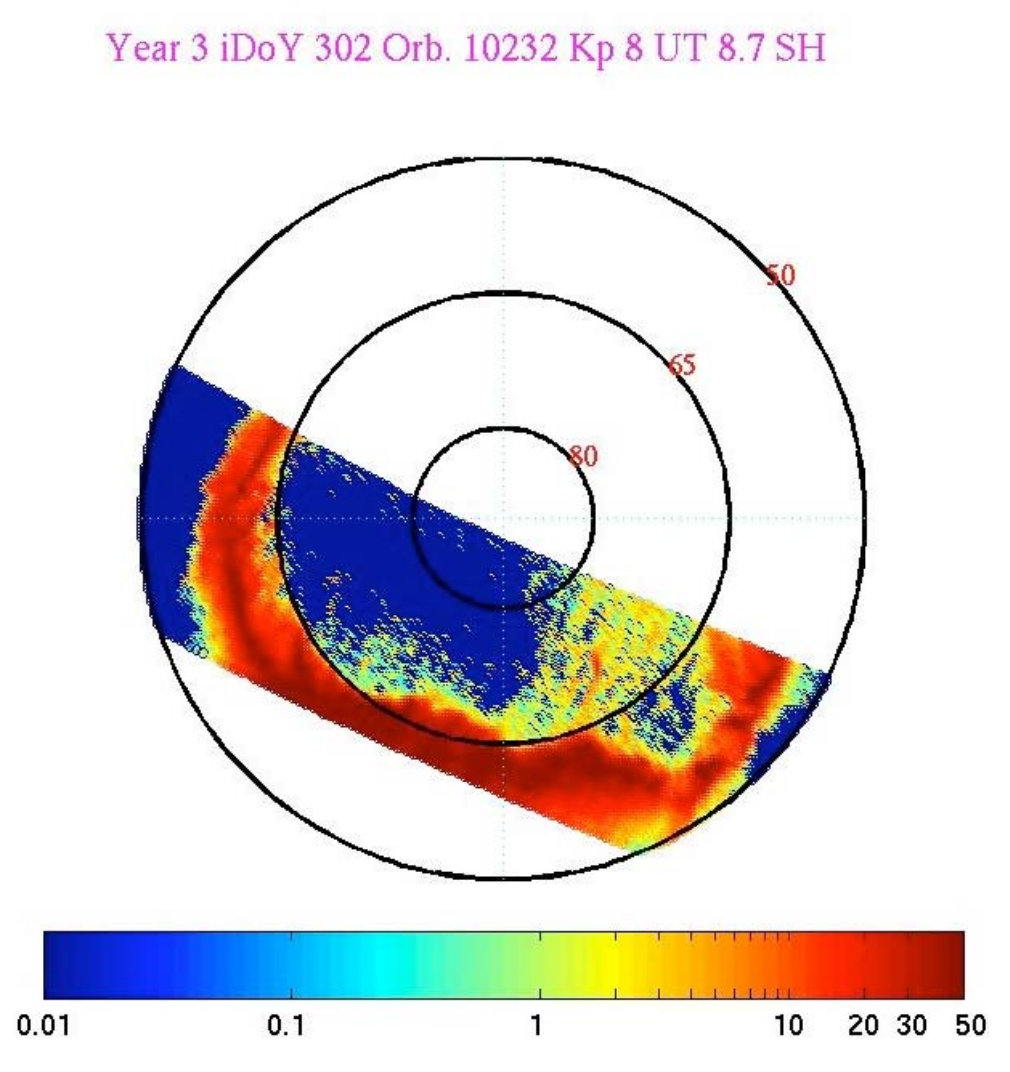
Kp Index and Hemispheric Power (HP)



Data from GUVI: Global Ultraviolet Imager

- Data from 2002-2007
- Average of Northern and Southern hemisphere over all seasons
- Binned with a resolution of 0.5° MLAT and 30 min MLT as a function of Kp index





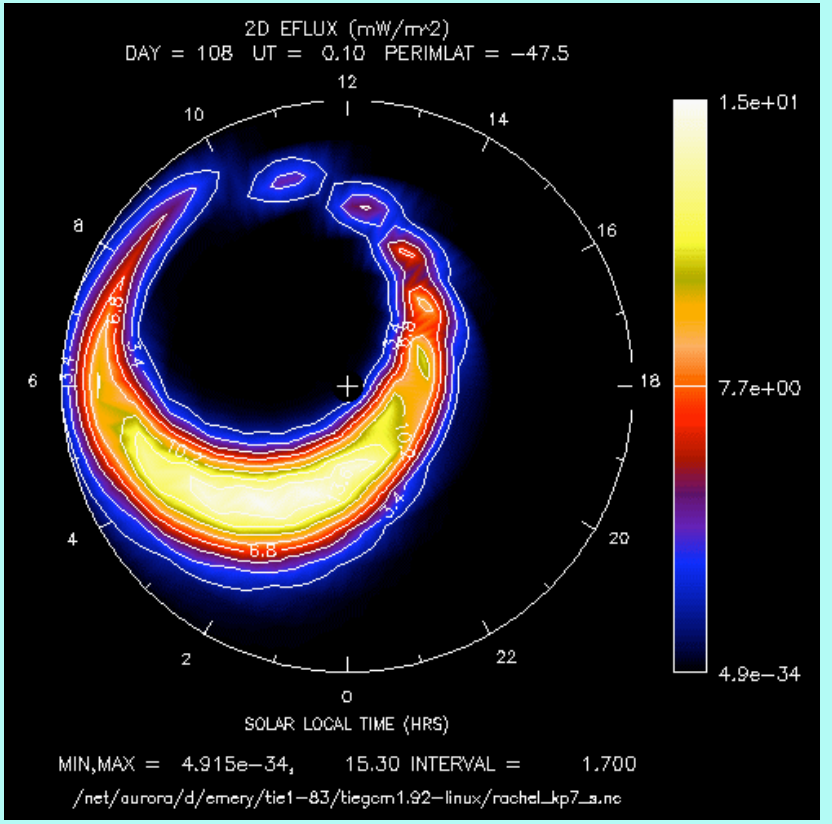
Thermosphere Ionosphere Electrodynamics General Circulation Model (TIE-GCM)

Auroral Input: Kp index

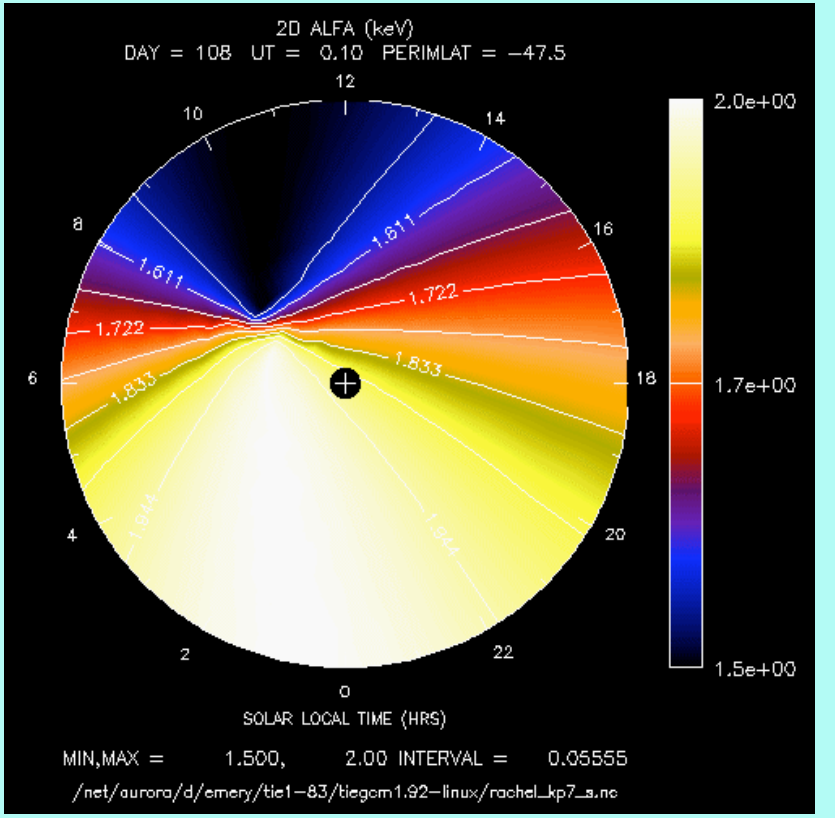
Resolution: 5° GLAT x 20 min LT

Auroral Models:

Energy Flux



Half Electron Mean Energy



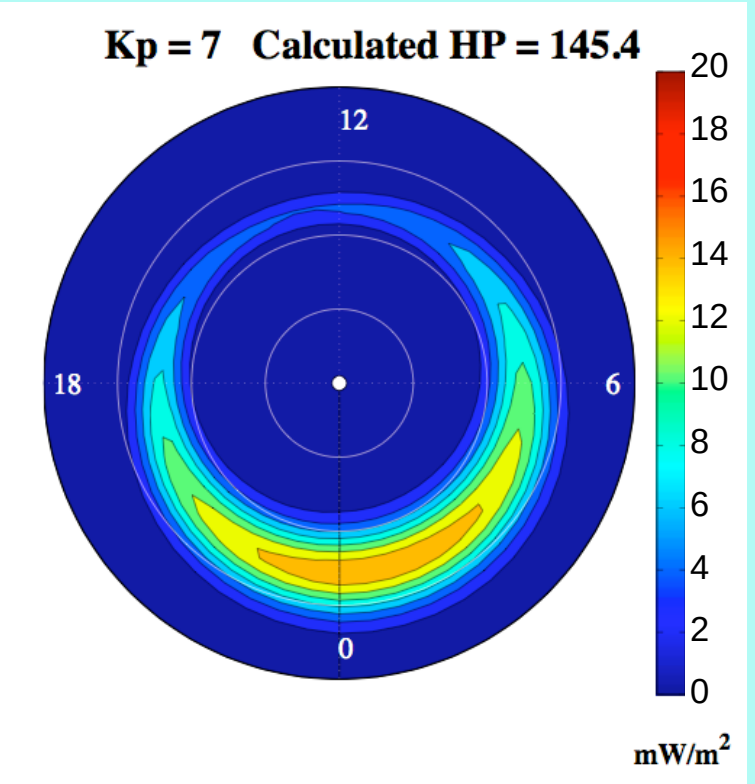
Plotting the TIE-GCM Model in GUVI Coordinates

Auroral Input: Kp index

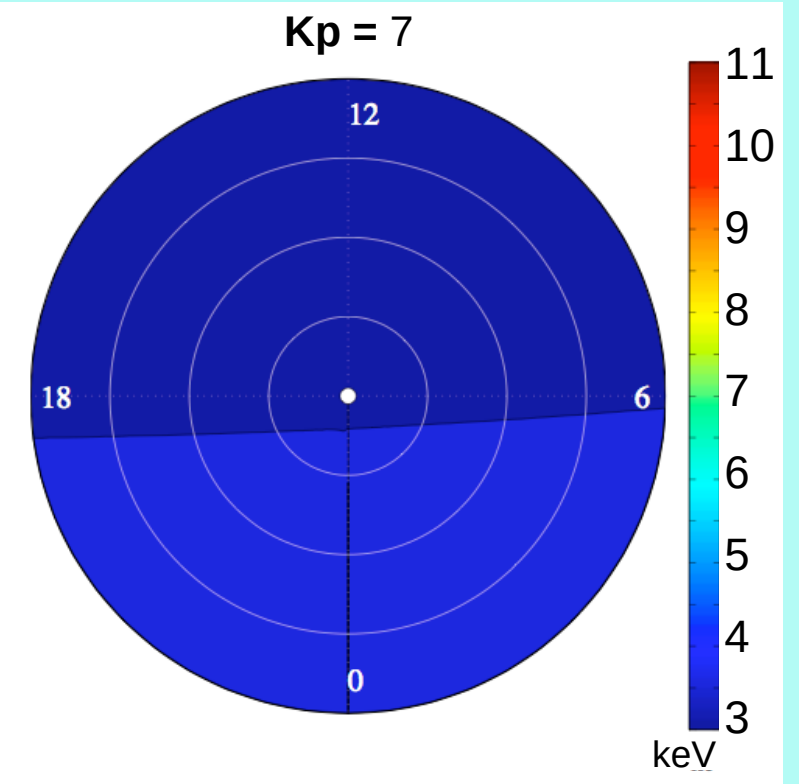
Resolution: 1° MLAT x 30 min LT

Auroral Models:

Energy Flux

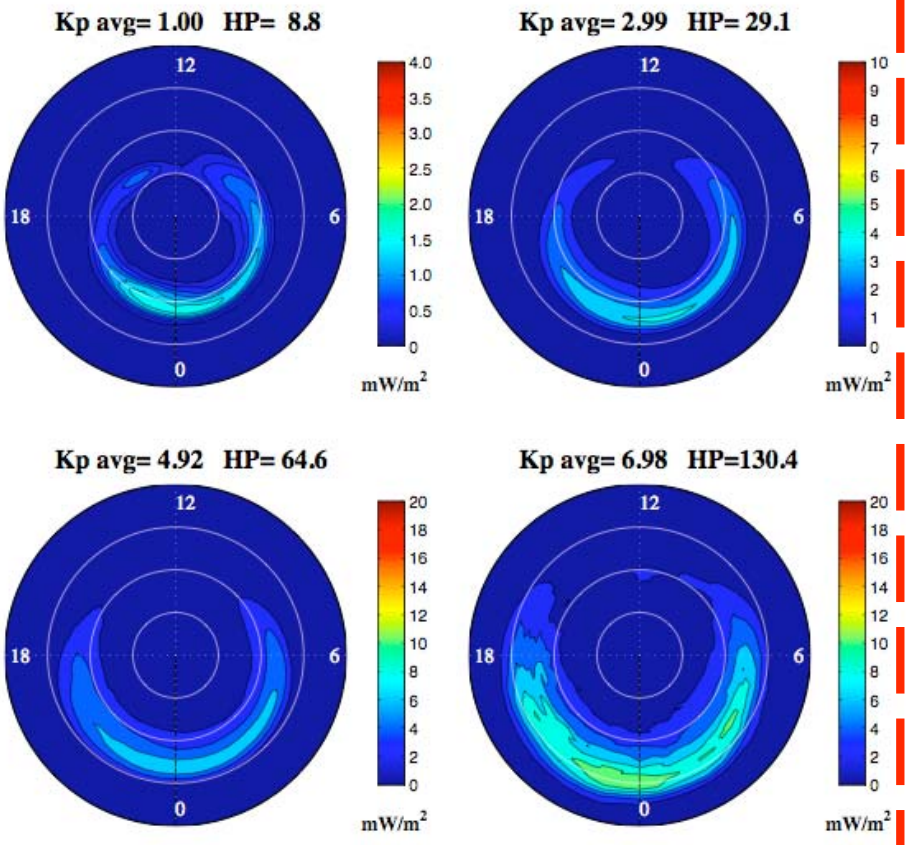


Electron Mean Energy

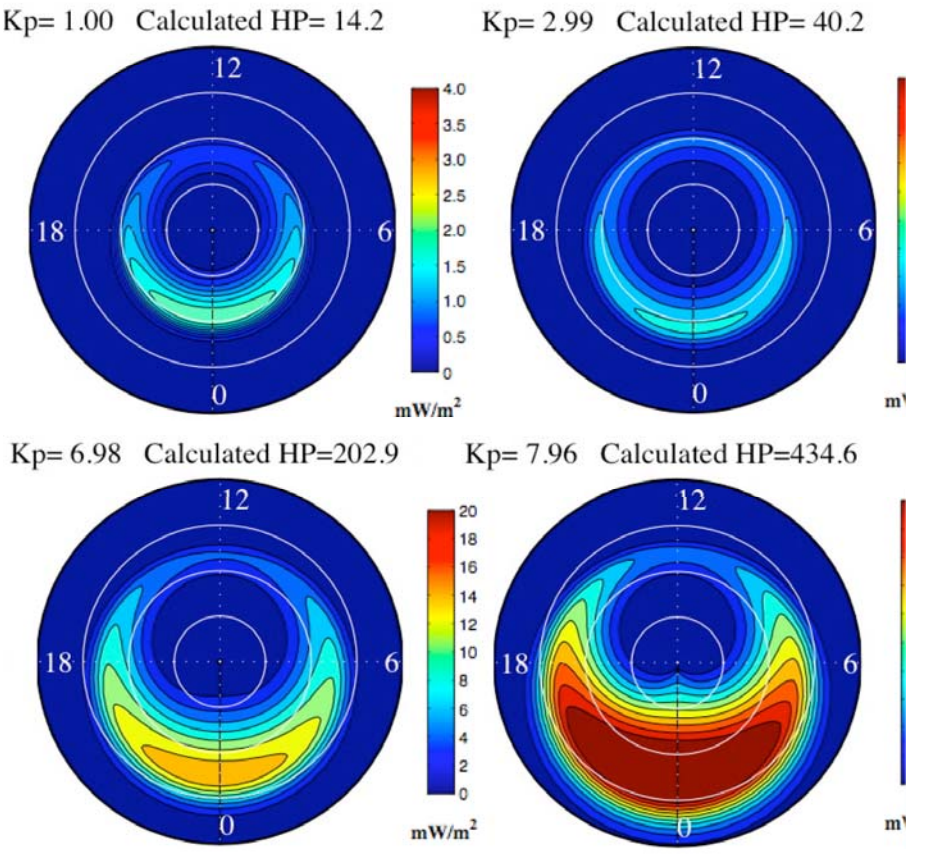


Energy Flux of the Aurora

Data from GUVI

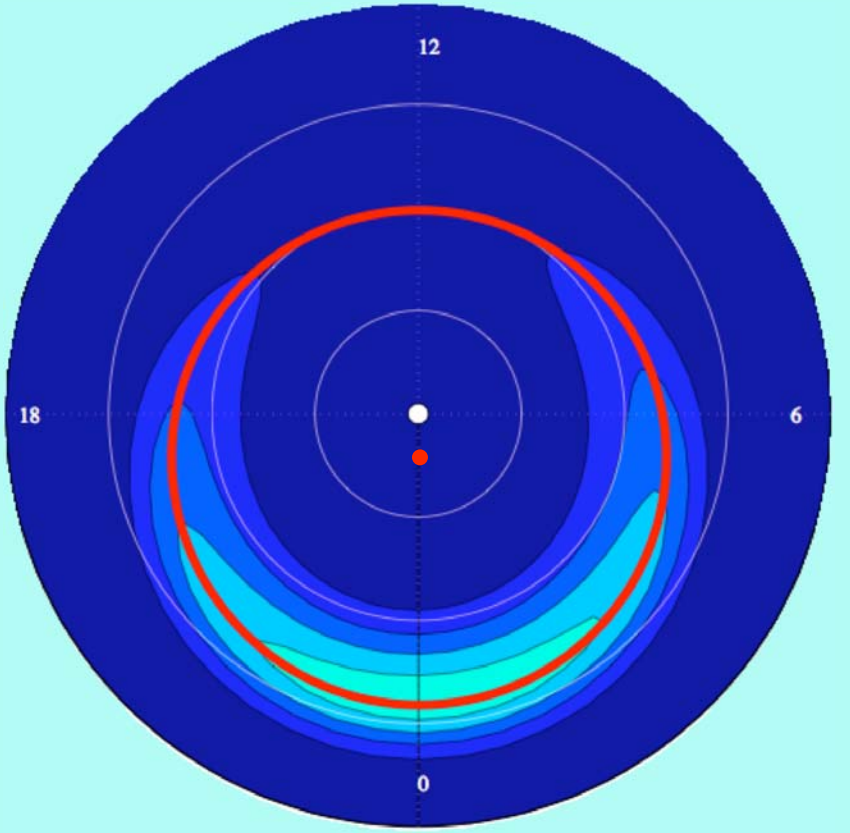


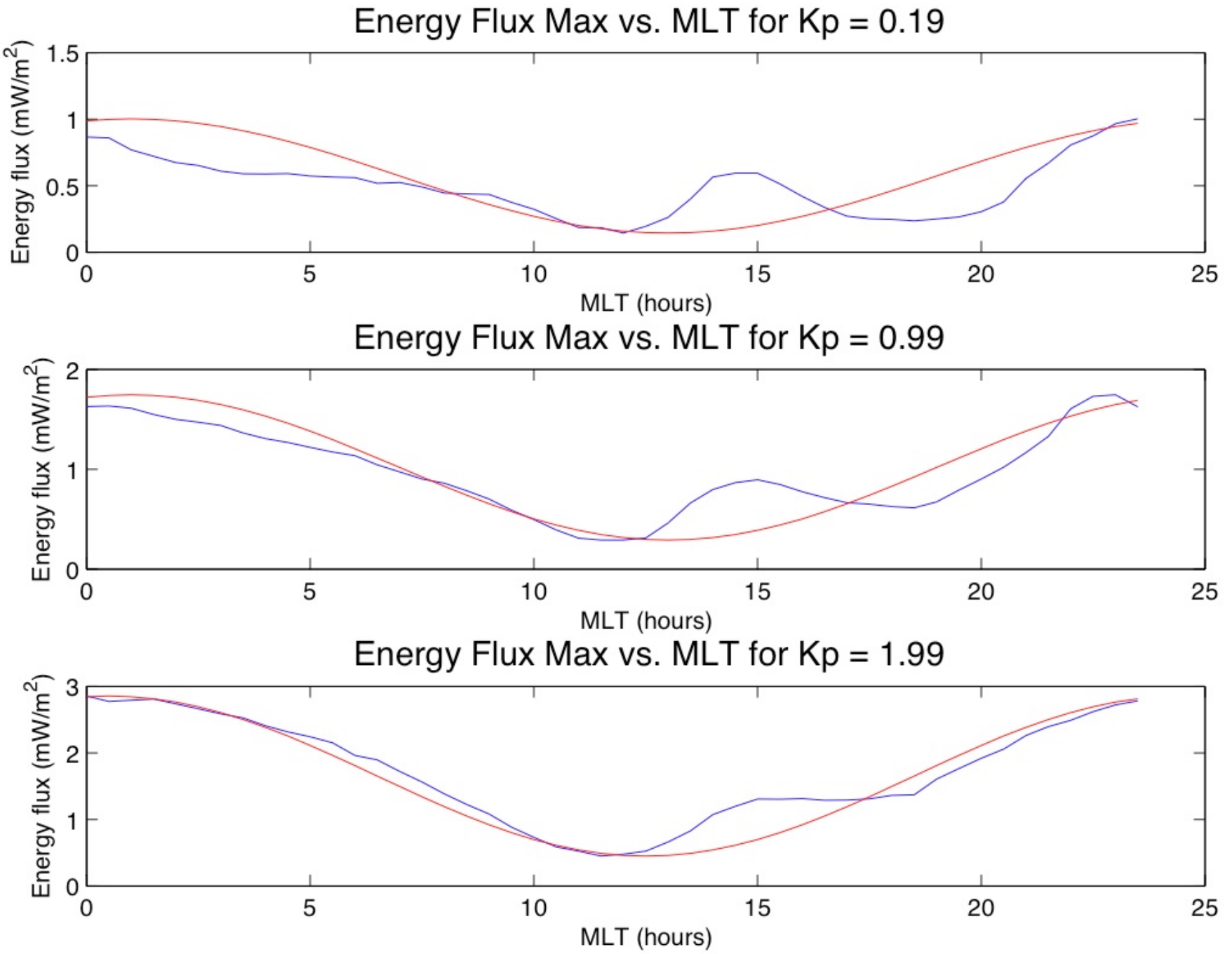
TIE-GCM Current Model

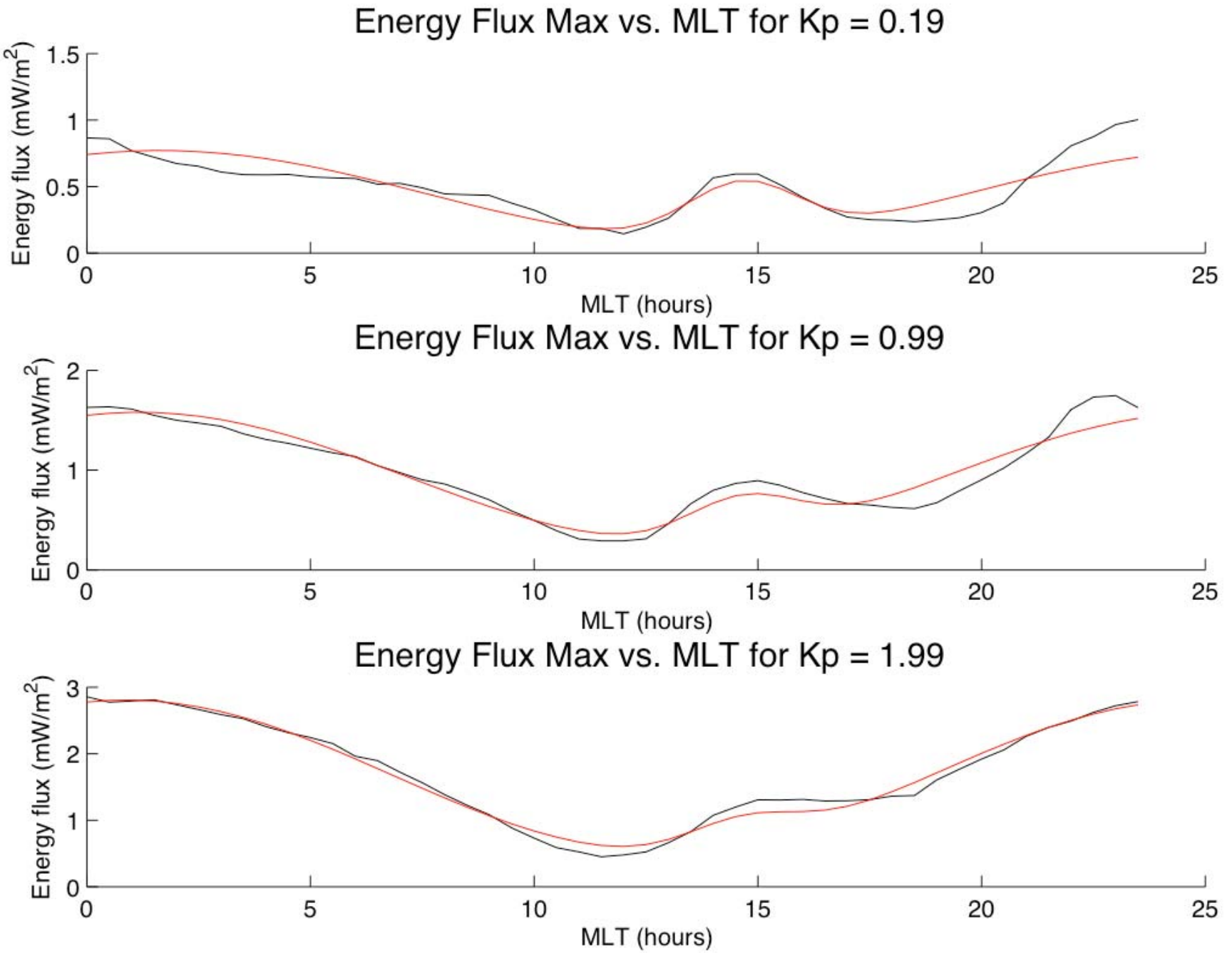


TIE-GCM Aurora Parameters

- Radius of the auroral oval
- Center of the auroral oval
- Maximum energy flux on the midnight side and the noon side
- Angular offset of the auroral oval
- Half-width of the aurora




Energy Flux Max vs. MLT for Kp = 0.19
Energy flux (mW/m^2)
1.5
1
0.5
0
0
5
10
15
20
25
MLT (hours)
Energy Flux Max vs. MLT for Kp = 0.99
Energy flux (mW/m^2)
2
1
0
0
5
10
15
20
25
MLT (hours)
Energy Flux Max vs. MLT for Kp = 1.99
Energy flux (mW/m^2)
3
2
1
0
0
5
10
15
20
25
MLT (hours)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Energy flux (mW/m^2)
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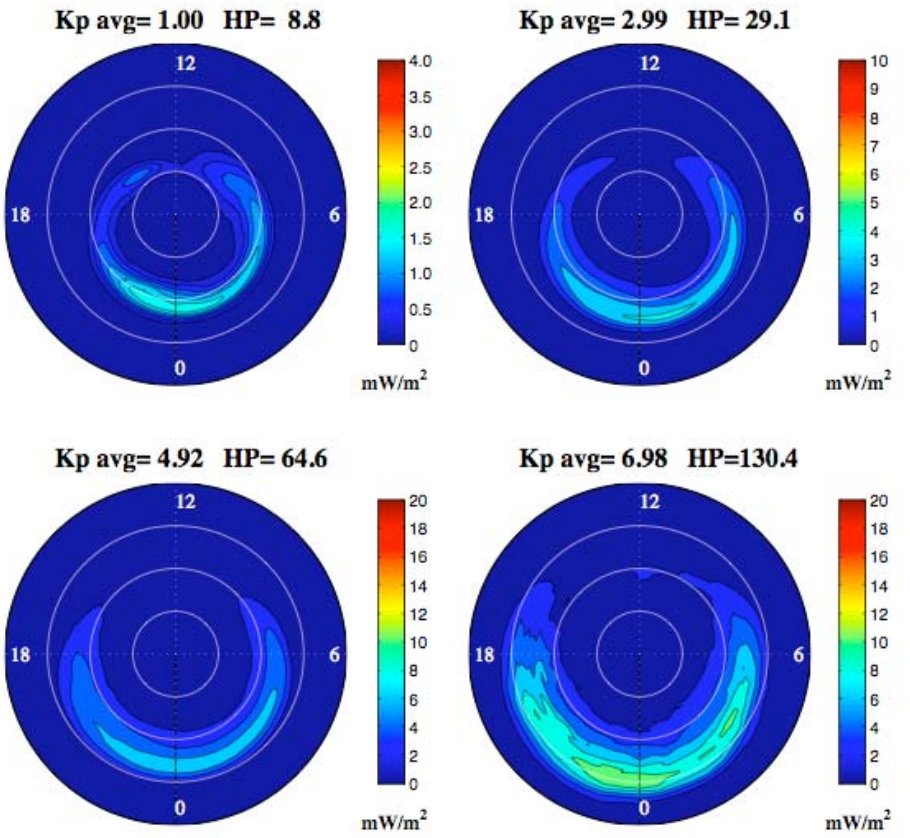
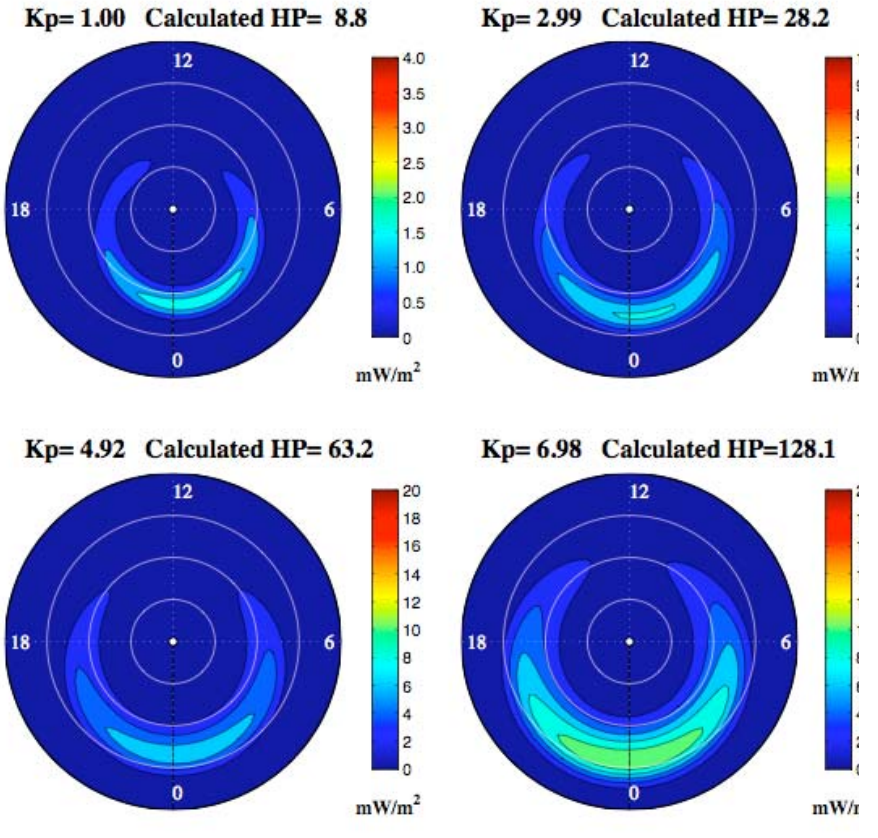
0.5
0
0
5
10
15
20
25
MLT (hours)
Energy Flux Max vs. MLT for Kp = 0.99
Energy flux (mW/m^2)
2
1
0
0
5
10
15
20
25
MLT (hours)
Energy Flux Max vs. MLT for Kp = 1.99
Energy flux (mW/m^2)
3
2
1
0
0
5
10
15
20
25
MLT (hours)

Energy Flux of the Aurora

Data from GUVI

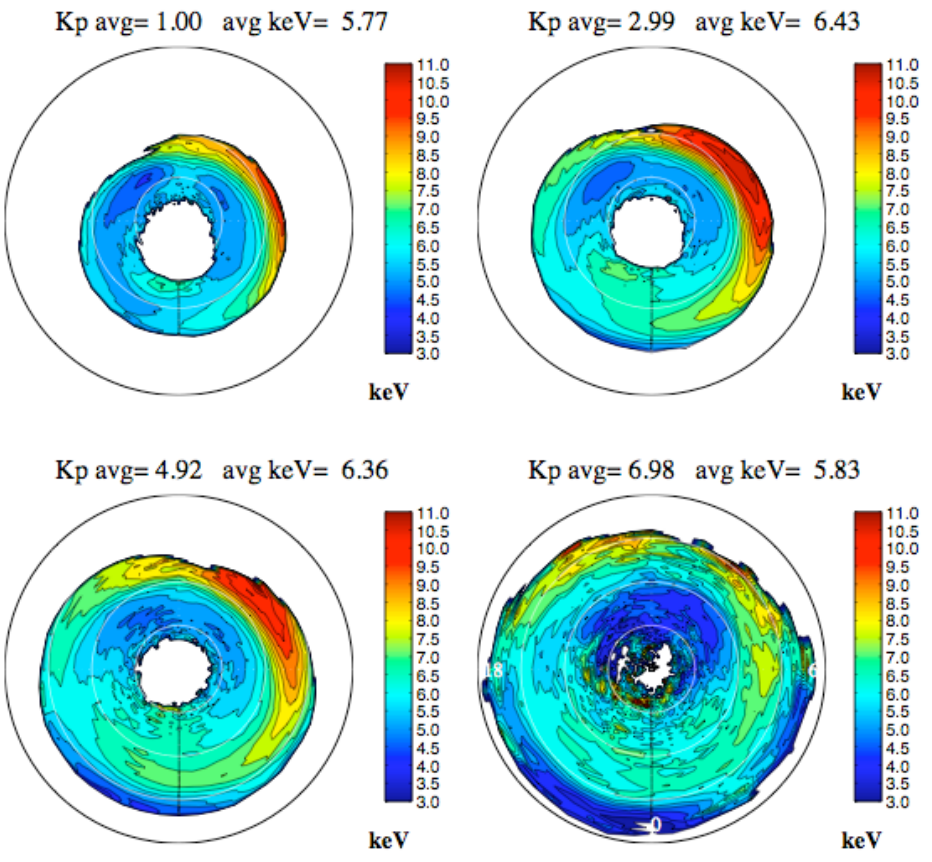


TIE-GCM with New Parameters

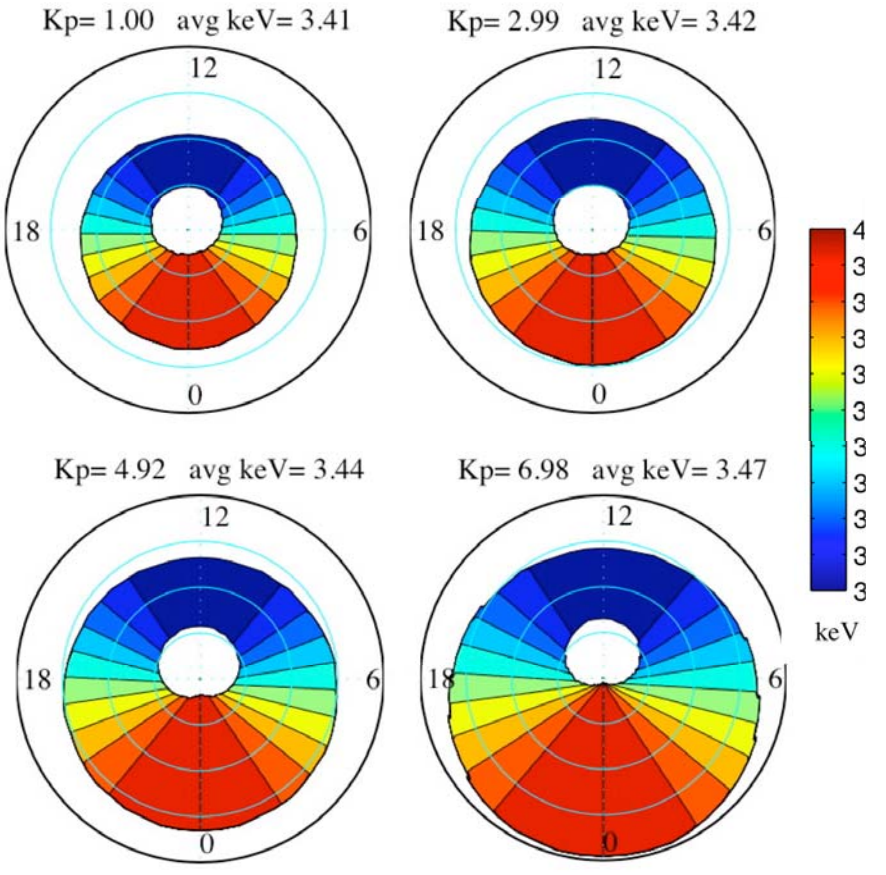


Electron Mean Energy

Data from GUVI

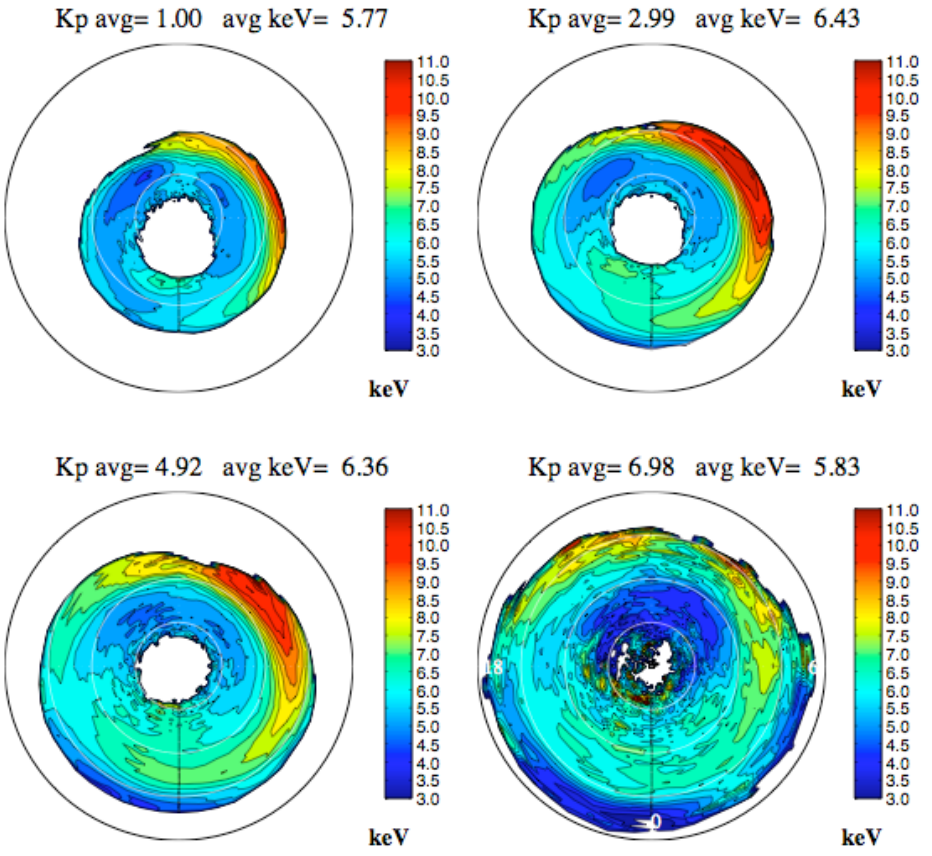


TIE-GCM Current Model

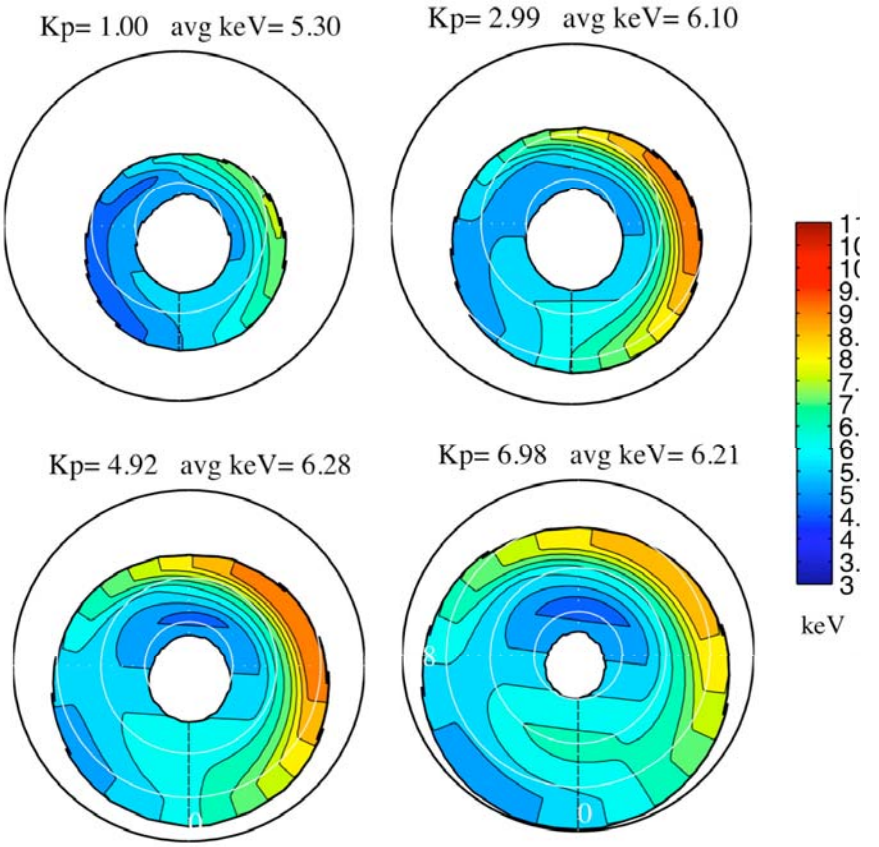


Electron Mean Energy

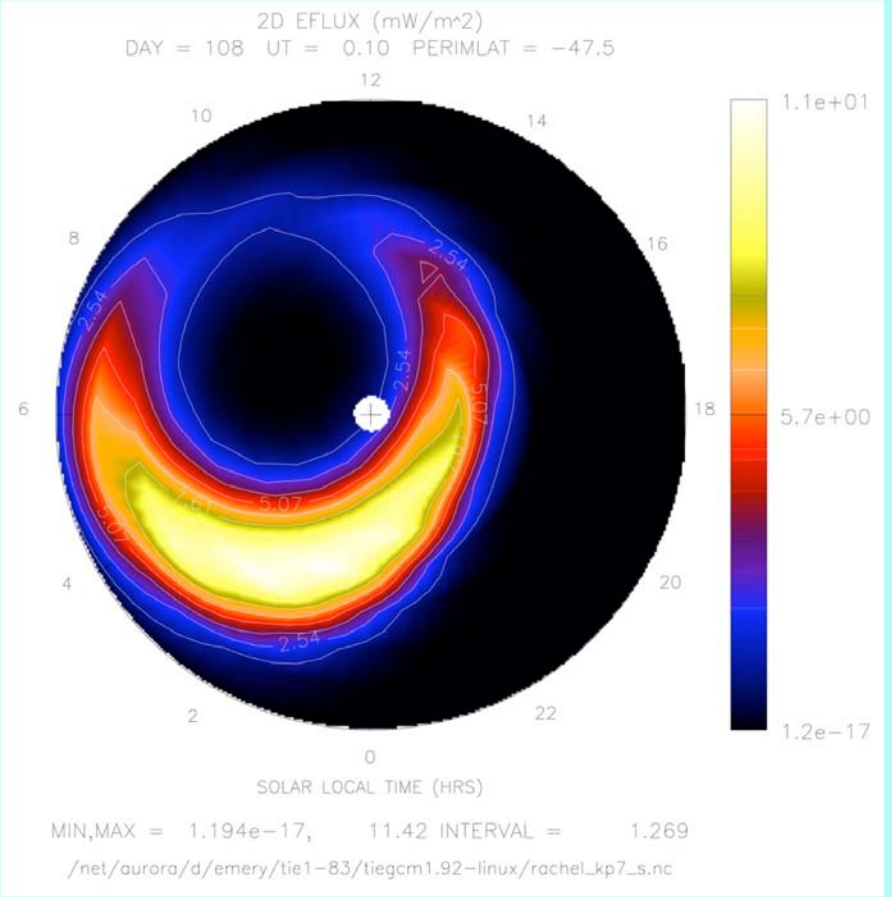
Data from GUVI

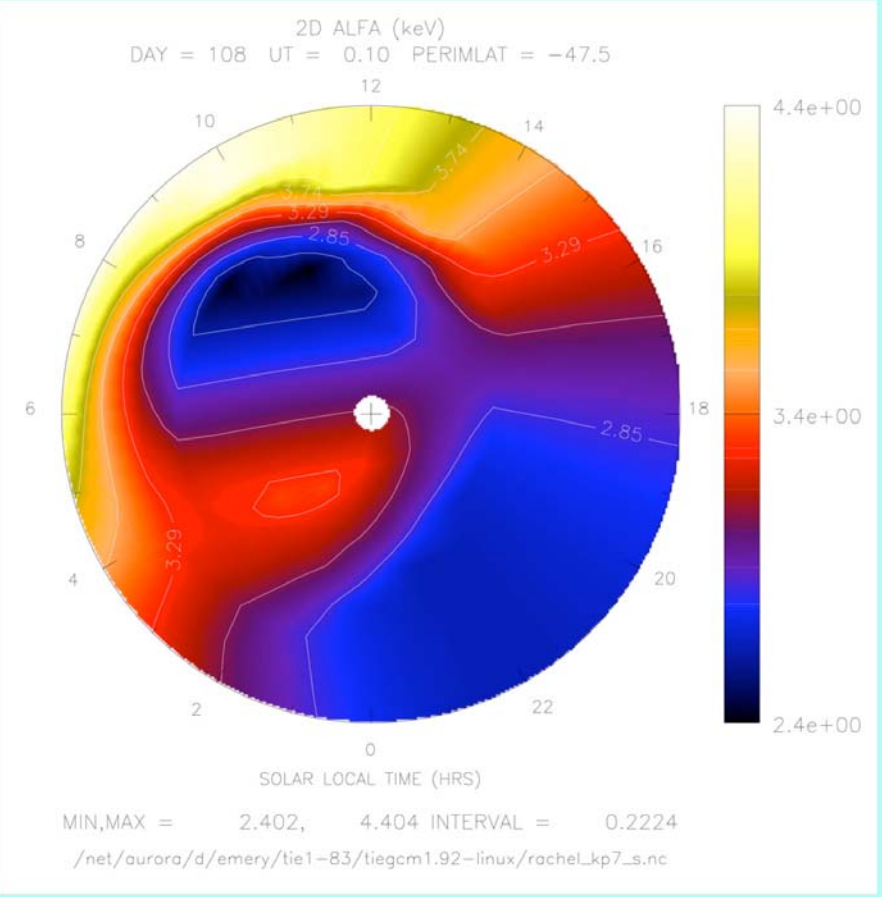


TIE-GCM with New Parameters



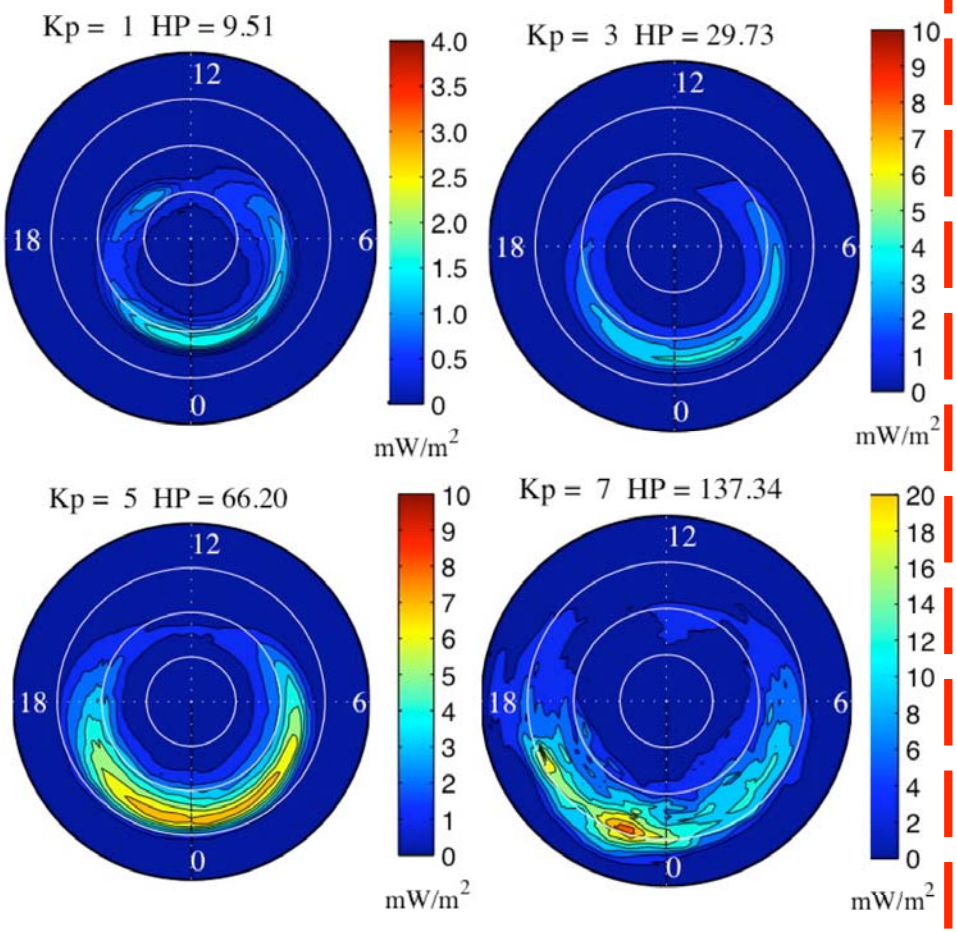
TIE-GCM in Geographic Coordinates with New Parameters



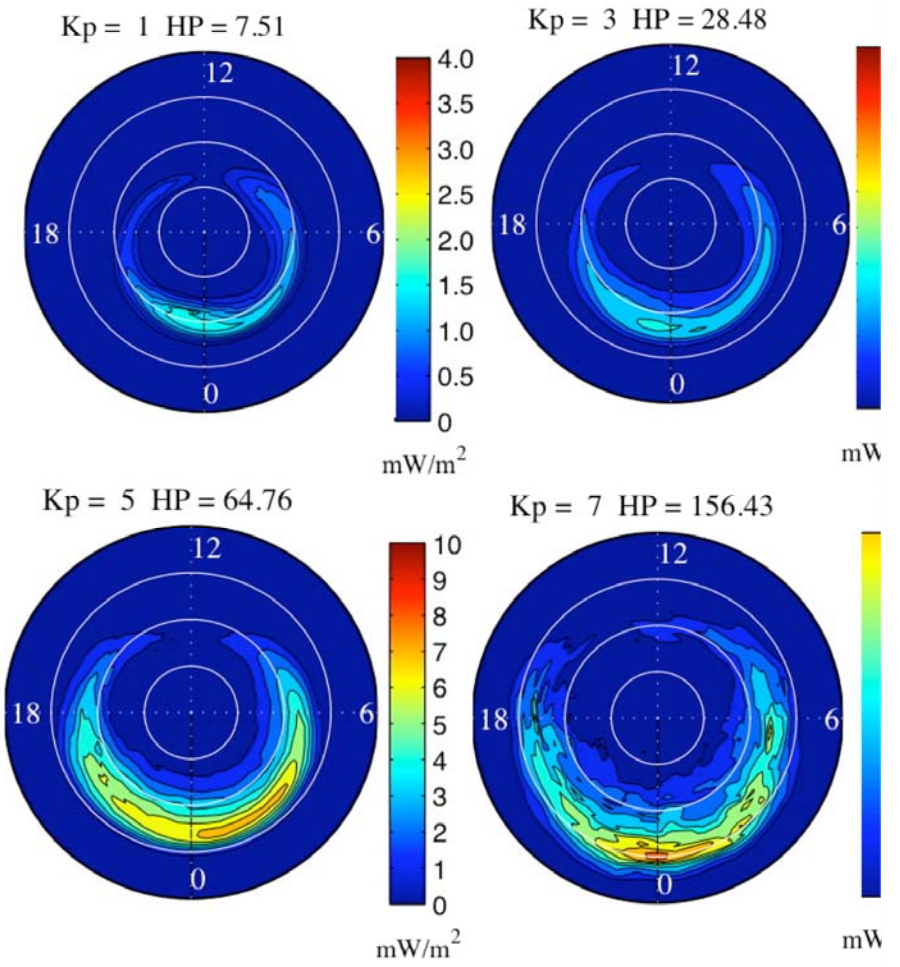


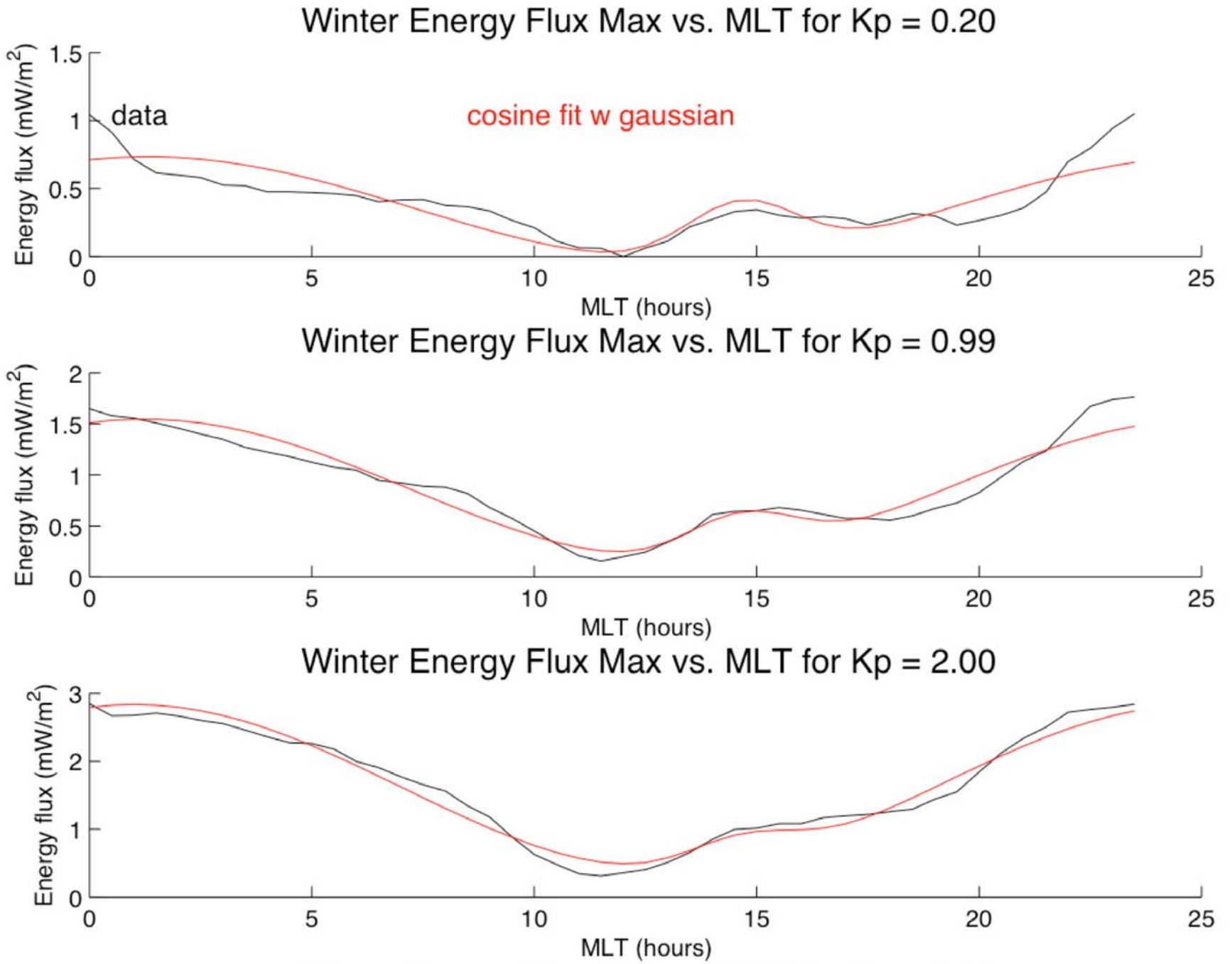
Seasonal Variation: Energy Flux

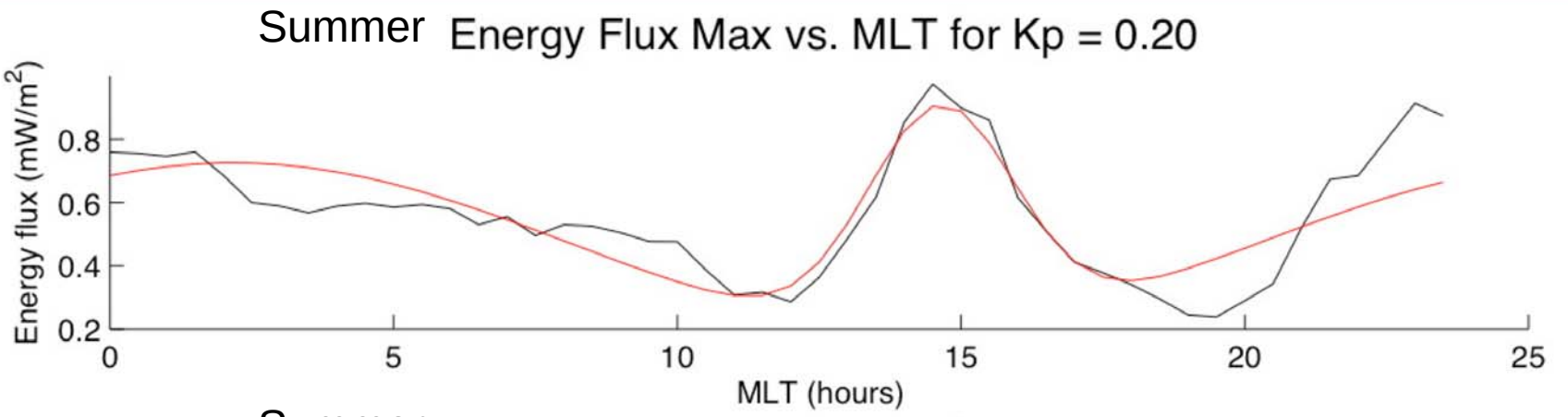
GUVI: Summer

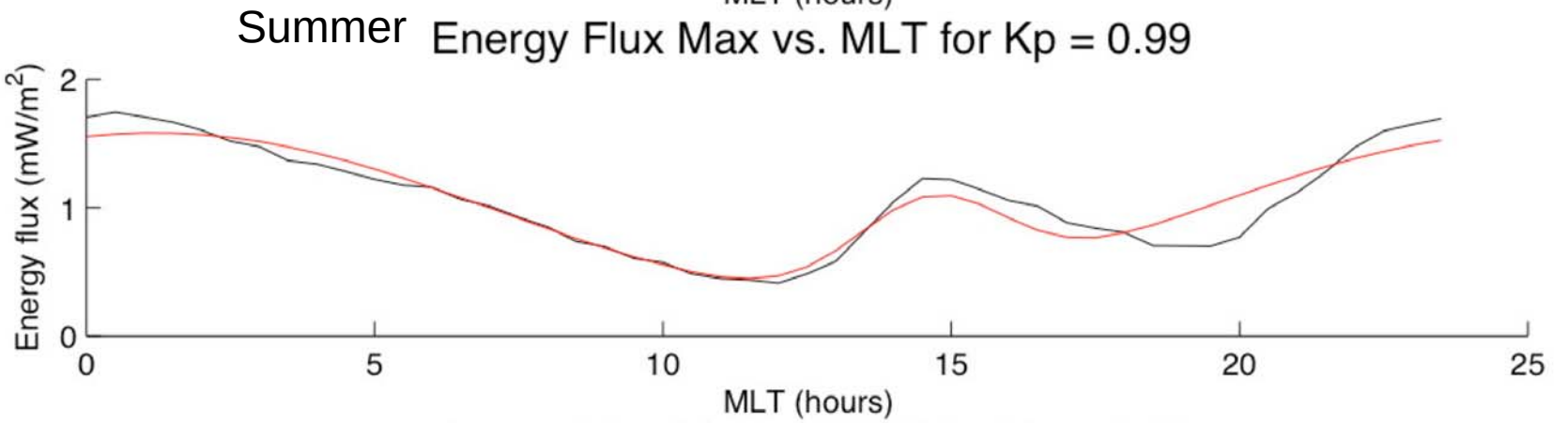


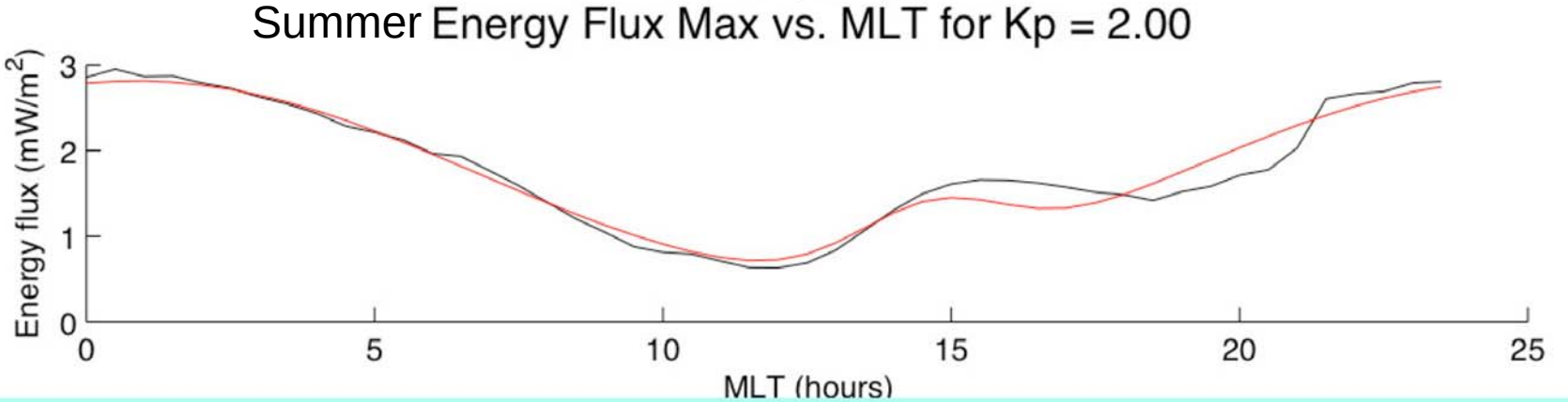
GUVI: Winter




Winter Energy Flux Max vs. MLT for Kp = 0.20
Energy flux (mW/m^2)
data
cosine fit w gaussian
MLT (hours)
Winter Energy Flux Max vs. MLT for Kp = 0.99
Energy flux (mW/m^2)
MLT (hours)
Winter Energy Flux Max vs. MLT for Kp = 2.00
Energy flux (mW/m^2)
MLT (hours)

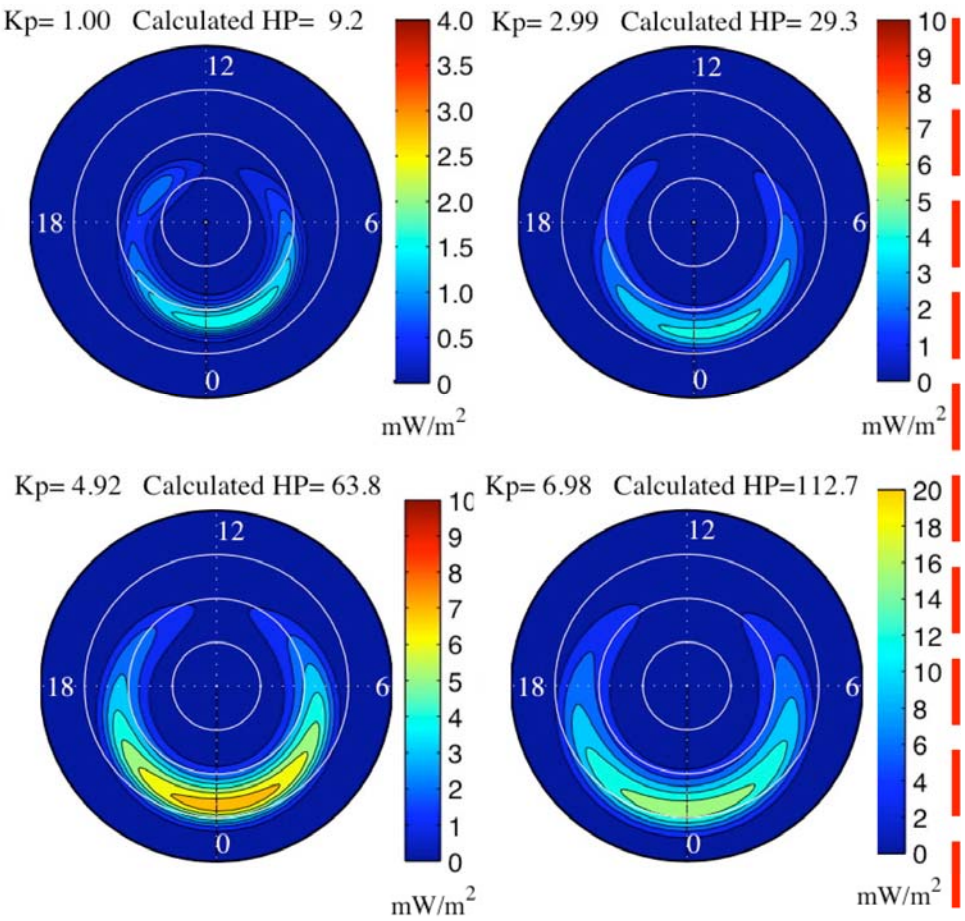

Summer Energy Flux Max vs. MLT for Kp = 0.20
Energy flux (mW/m^2)
0.2
0.4
0.6
0.8
0
5
10
15
20
25
MLT (hours)


Summer Energy Flux Max vs. MLT for Kp = 0.99
Energy flux (mW/m^2)
0
1
2
0
5
10
15
20
25
MLT (hours)

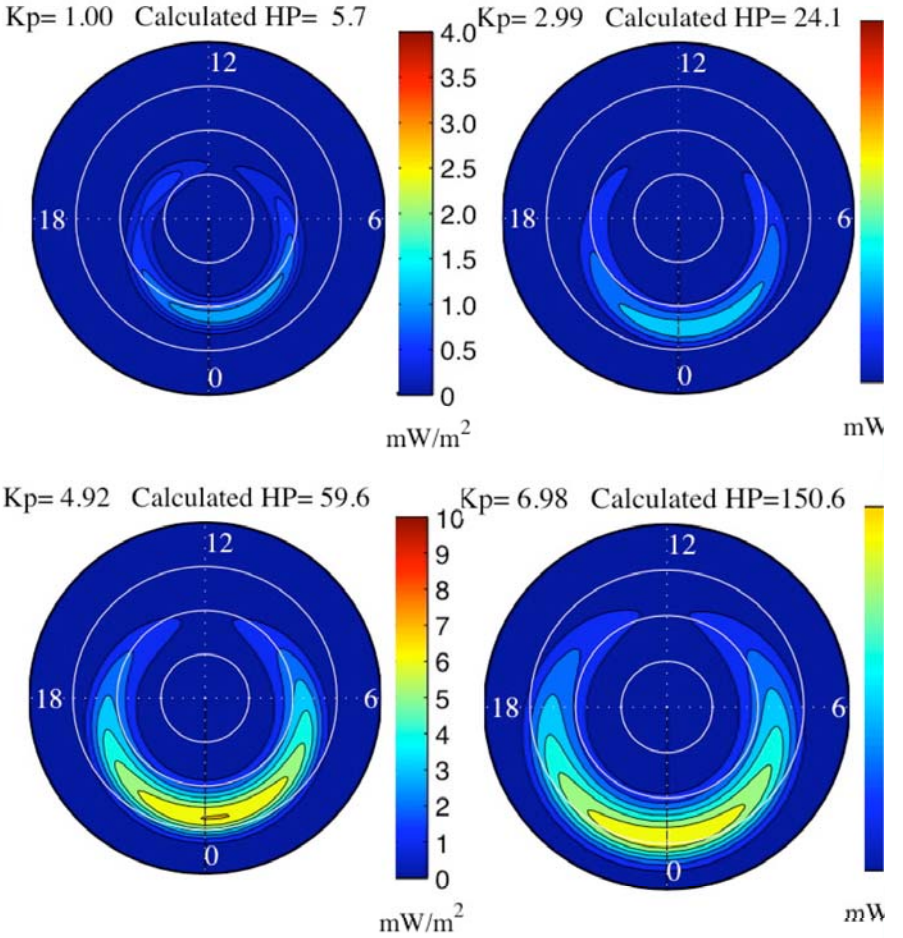

Summer Energy Flux Max vs. MLT for Kp = 2.00
Energy flux (mW/m^2)
0
1
2
3
0
5
10
15
20
25
MLT (hours)

Seasonal Variation: Energy Flux

TIE-GCM: Summer

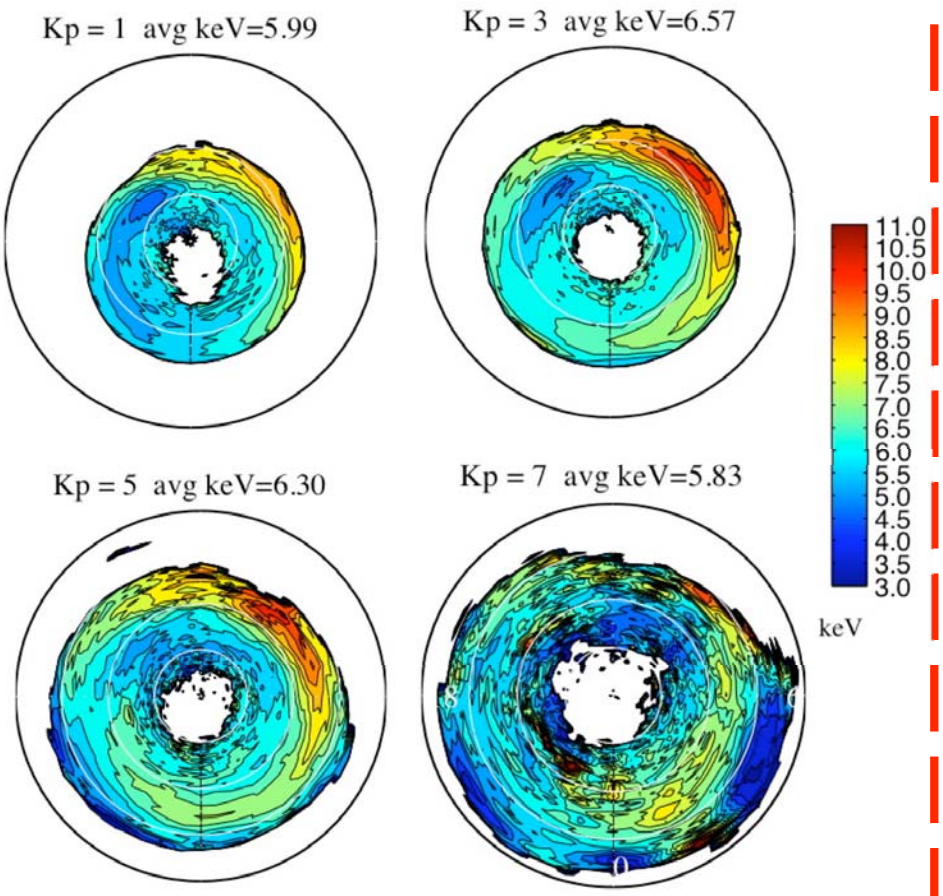


TIE-GCM: Winter



Seasonal Variation: Mean Energy

GUVI: Summer



GUVI: Winter